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Globalization of Ayurvedic Medicines

An Analysis of Issues in Resource Management

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Globalization of Ayurvedic Medicines: An Analysis of Issues in Resource Management

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Abstract

Ayurveda largely enumerated botanical entities as active pharmacological agents for preventive healthcare as well as for therapeutic purposes. In view of poly-pharmaceutical practices followed by the system, the number of usable medicinal plants is also significant. To available estimates, 960 species of medicinal plants are being used for manufacturing of these formulations. By and large, these plants are sourced from wild- more in particular from forest sources. On the other hand, there have been ambitious endeavor to globalize the Ayurvedic products and services. Such endeavor is reasonably assumed to pressurize the existing sources wild medicinal plants. Therefore, it is necessary to analyze the impact of globalization on the biological diversity and thereby on our eco-systems as whole.

An attempt is made in this paper to analyze the issues associated with resource management for medicinal plants. Further, it attempts to outline a multi-dimensional intervention needed to capture the economic opportunities through globalization of Ayurveda.

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Introduction

The history of Ayurveda (and other manifestations of traditional medical systems) during last 250 years of span has been marked by a tripod of Institutionalization, Industrialization and Internationalization. First two of these three developments were triggered by the emergence and evolution of allopathic medicine- which is now termed and accepted as Modern systems of medicine (MSM). As a result of competitive challenges posed by Western medicine- the education in Ayurveda moved from a "*Guru-sishya parampara*", to colleges and Universities. This process faced many upheavals. Though some degree of policy support came from the rulers once a while, it was not consistent. Larger part of this activity was pulled forward by patriotic scholars.

In parallel, the preparation of Ayurvedic medicines moved from the backyard of physician's home to factories triggering a process of manufacturing. This process had been more challenging to the sector. In general, certain pharmaceutical dosage forms used in Ayurveda are very unique to traditional systems of medicine. Physicians undertook these processes in a kind of bench-top scale using domestic vessels. For up-scaling the product, mechanization was called for. Designing appropriate machinery to suit the traditional dosage forms required an engineering excellence. Such competencies neither were accessible nor were affordable for the budding sector. Despite this bottleneck, the sector evolved to its full potential. Today, complex dosage forms *like Bhasmas, Asava-Arishta* group and *Awaleha* group are produced–under mechanized conditions without compromising the underlying pharmaceutical principles of Ayurveda.

These two historical stages in the annals of Ayurveda together, lead to an ambition of "internationalization" or "globalization". We consider it as an 'ambition' for one practical reasons that, globalization is not critical to the very survival of Ayurveda- though it helps to strengthen the system further. Nonetheless, the process of globalization is now augured by two specific factors:

- Socio-economic developments which swept across the world and had a specific bearing on global healthcare scenario
- Technical limitations of MSM particularly on account of preventive health and chronic degenerative disorders

These two plausible reasons drive opportunities for export of healthcare formulations and dietary supplements based on Ayurveda. Further, globalization of Ayurveda also creates lucrative economic opportunities for the services sector based on Ayurveda.

Challenges of Globalization

Since the prevailing scenario in the healthcare is favorable for globalization of Ayurveda, one can take a positive note about this development. However, an equal amount of attention is required address certain challenges posed by the process of globalization.

1. Cultural Challenges: Acceptance of Ayurveda in India is actually rooted in deep cultural foundations. Indians identify the system as integral part of their cultural and intellectual heritage. Because of such trust more often than not, Indians tend to accept the system with a kind of cultural trust. Thus demand for objective evidences is not so marked. On the contrary, the western world may not be ready to accept the system without a demand for objective validation.

2. Regulatory Challenges: By and large, the regulatory mechanisms prevailing in the western world are created in line with reductionist approaches of single molecular entities used in modern medicine. Hence, these mechanisms are supportive to harden the cultural barrier.
3. In parallel to these challenges, the concerns associated with the medicinal plant resources need to be analyzed. Unless appropriate mechanisms are evolved to address this concern all other endeavor to address the first two forms of challenges may go futile.

In this working paper an attempt is made to analyze the issues associated with management of bio-resources critical to growth and globalization of Ayurveda.

Botanical Resources in Medicine

Use of botanical resources for medicinal purposes is not just limited to Ayurveda and other forms of traditional medicines. A large number of existing drug molecules used in MSM have a process pathway traceable to botanical sources. The data bases at FRLHT Bangalore enumerated a total of 6581 botanical species which are in use by various medical systems. The teams at FRLHT analyzed existing usage overlaps to arrive at total number of Indian medicinal plants being used across medical systems (Fig-I).

As seen from this cross tabulation- Ayurveda is known to use 1537 species of medicinal plants. However, in today's context, all of them are not in industrial use.

Figure-I: Cross Tabulation Showing the No. of Medicinal Plants used across medical systems**:

	AYURVEDA	FOLK	FOLK Veterinary Health	HOMEO.	SIDDHA	TCM	TIBETAN	UNANI	WESTERN
AYURVEDA	**1537**	773	310	176	756	360	246	427	74
FOLK	773	**5215**	283	161	771	672	186	330	80
FOLK-Veterinary Health	310	283	**545**	47	300	128	69	111	14
HOMEO.	176	161	47	**489**	145	128	69	136	102
SIDDHA	756	771	300	145	**1147**	289	209	334	59
TCM	360	672	137	128	289	**880**	109	205	80
TIBETAN	246	186	82	69	209	109	**250**	177	23
UNANI	427	330	111	136	334	205	177	**493**	63
WESTERN	74	80	14	102	59	80	23	63	**190**

Totals: 6581 Species

**** Courtesy: Institute of Ayurveda & Integrative Medicine (FRLHT), Bangalore: (BOTMAST Database of IAIM-FRLHT; 2012)**

Further, it may be observed from the above cross tabulation, significant number of medicinal plants is common between folk medicine (ethnomedicine) and codified systems of medicine. Further, it may be noted that, a significant number of medicinal plants are also used for the purpose of veterinary healthcare- which eventually branched out as Pashu Ayurveda in the codified systems of tradaitional knowledge.

But in today's' context, not all the 1500 and odd species mention in Ayurveda are not used for two visible reasons. Firstly, some of those species cited in classical literature are not identified and resolved from a botanical nomenclature point of view. In some cases, it is even possible that, the species went extinct or at least, facing extinction.

As per the data collated by a study sponsored by National Medicinal Plants Board during year-2008, a total of 960 species are recorded to be in trade (1). The same report also recorded 178 species to be high volume trade, exceeding 100 MT (on dry basis). 137 of these 178 species in high-volume trade are of wild origin with only 41 species coming from cultivation. It is equally important to note that, the wild medicinal plants need not essentially come from forests only. Agricultural weeds, species grown in wastelands also are treated as wild medicinal plants.

Poly Pharmacy in Traditional Formulations

As seen from the above table, the codified systems of medicine largely depend upon botanical entities as pharmacological agents. Each of the botanical entity is known to be a complex storehouse of multiple chemical entities. This complexity is further multiplied by using them in combinations. This kind of practice adopted by traditional medicines is termed as 'poly-pharmacy'. This approach can be further described as under:

- It is generally known that, the modern system of medicine uses the drugs drawn from single molecular entities (SMEs). These molecular entities can be developed through a chemical synthesis or derived from natural products such as bacteria, fungi and botanical species. The drug molecules are identified by a process of 'bio-activity guided fractionation'.
- As against this practice, the traditional formulations (in Ayurveda, Siddha, Unani) contain multiple herbal ingredients. For example, popular Ayurvedic formulation *Chyawanprash Awaleha* contains 44 herbal ingredients. An oil based product used for application and massage for relieving joint pains- *Mahanaryan Taila* contains 62 medicinal plants. Another classical Ayurvedic formulation *Mahasudarshan Churna* is prepared by combining the fine powders of more than 50 medicinal plants.
- Also, each of the herbal species goes into multiple formulations. For example, Amla (*Emblica officinalis*) and Pippali (*Piper longum*) is used in all the three formulations illustrated above but in different concentrations.
- In most of the formulations one or two ingredients are used in significantly in higher concentrations making them major ingredients. Rest of the ingredients is used smaller concentrations. For example, Amla (*Embilca officinalis*) is prime ingredient of

Chyawanprash Awaleha. Kiratatikta (*Swertia chirata*) is main constituent of Mahasudarshan Churna.

The following Table captures an analysis of 625 formulations enumerated in Volumes I and II Ayurvedic Formulary of India (2) with reference to the number of ingredients used in various sets of classical Ayurvedic formulations

Category (Based on No. of Ingredients)	**Distribution Pattern Among Total Formulations (as per AFI) – across dosage forms**		
	Solid Dosage forms	Semi-solid Dosage Forms	Liquid dosage forms
Formulations having Up-to 10 Ingredients	60%	26%	28%
Formulations having 11-20 Ingredients	26%	33%	32%
Formulations Containing > 20 Ingredients	14%	41%	40%

The practice of poly-pharmacy has its own influence on the existing trading mechanisms. Also, it has major implications on the resource management issues.

Medicinal Plants in Trade

It is generally assumed that, the trading with medicinal plants was precipitated by industrialization of AYUSH based medicines and healthcare formulations. This assumption though seems to be logical it needs a critical view in the light of few factual positions:

In the practices of poly-pharmacy, each product draws its ingredients from different geo-climatic zones. For example, Chyawanprash uses Pushkarmool (*Inula racemosa*) from high Himalayas, Punarnava and other spices from coastal plains, Amlaki (*Embilca officinalis*) Bhumyamlaki (*Phyllanthus amarus*) from Central India and Gokshura (*Tribulus terrestris*) from Semi-arid zones (3). In absence of some aggregation and trading mechanism there was no possibility for making the product even at physician's homes.

Citations in works like *Harsha Charita*(4) and *Kautilya's Arthas'astra* & *Chanakya Sutra* (5) indicate the prevalence of trading with medicinal plants in addition to spices (which are also often used in Ayurvedic formulations). However, these citations could not give any indication on the scale of the trades prevailed in those eras.

Post industrialization- the scale of trading started measuring new strides. Though there is no syndicated data on trading of medicinal plants- it could be safely assumed that, the consumption of medicinal plants by industry recorded 8-15% growth rate YoY in last 2 centuries. Particularly, during last decades, the growth in demands in medicinal plants is maintained in double digits. This assumption is based on the growth rate of industry and

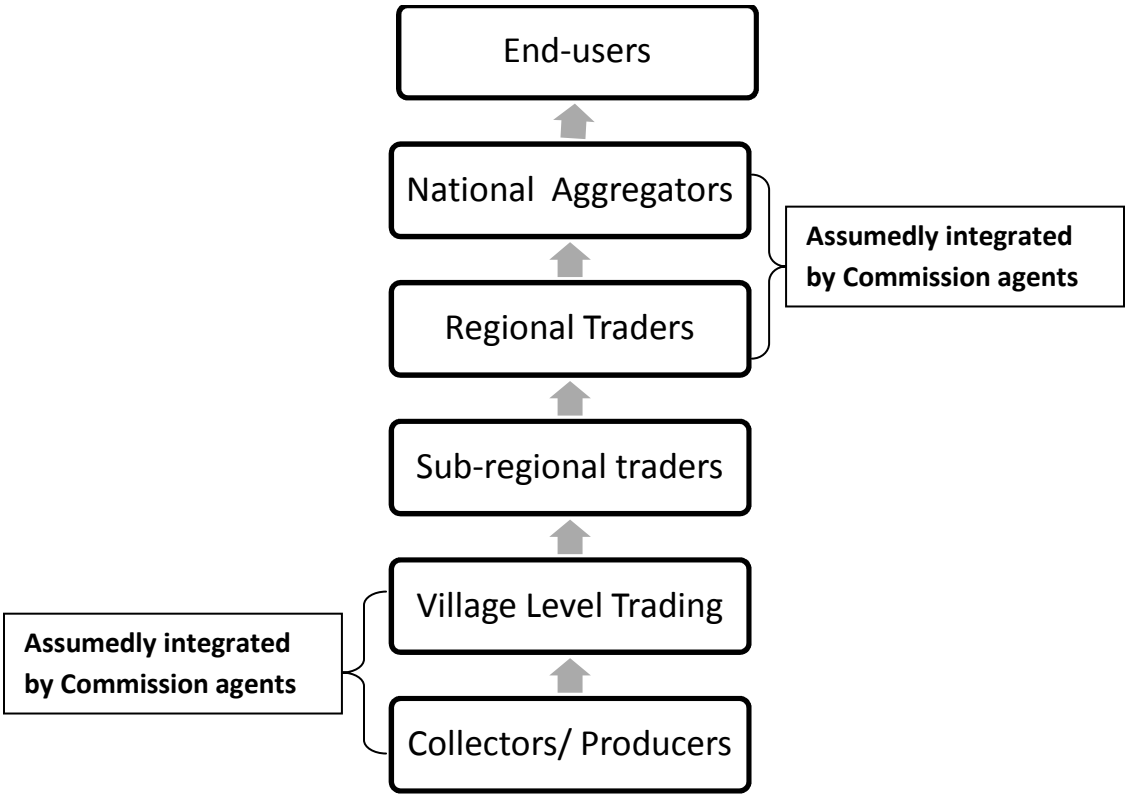
related demands for finished products. The following features characterize the trade of herbal raw materials.

- The trade is highly unorganized and remained close fisted through its known history of over 200 years. Existing traders claim inheritance of trade from their ancestors. Hence, they claim traditional expertise in handling the process.
- The supply chain for wild or cultivated medicinal plants across the country involves multiple stakeholders. Traceably, middlemen and commission agents are involved in the process of aggregation to national markets.
- The collection and trading practices are associated with qualitative, quantitative and regulatory issues.
- Cultivation of medicinal plants is being tested by farmers almost on a continuous basis. More often than not, the attempt has been inconsistent in terms of species. As of now, only 41 of 178 high-volume botanical drugs come from purely cultivated sources.
- Existing regulatory framework failed to take the importance and intricacies of the trade into cognizance. Excepting for collection of trade taxes at all possible levels- none of other regulations worked in tandem. As a result the trade remained un-sanitized.

Trading Mechanism & Supply Direction

Since the whole process of trading is not tracked adequately and remained unorganized, it is practically define the prevailing mechanisms of supply. As a matter of assumption largely, the wild medicinal plants are collected by forest dwellers move to national markets through a multi-stakeholder's supply channel. This process can be illustrated in the following figure-II (though this not universal scheme for all the species recorded in trade and for all regions)

Figure-II: Illustrating Trading Mechanism



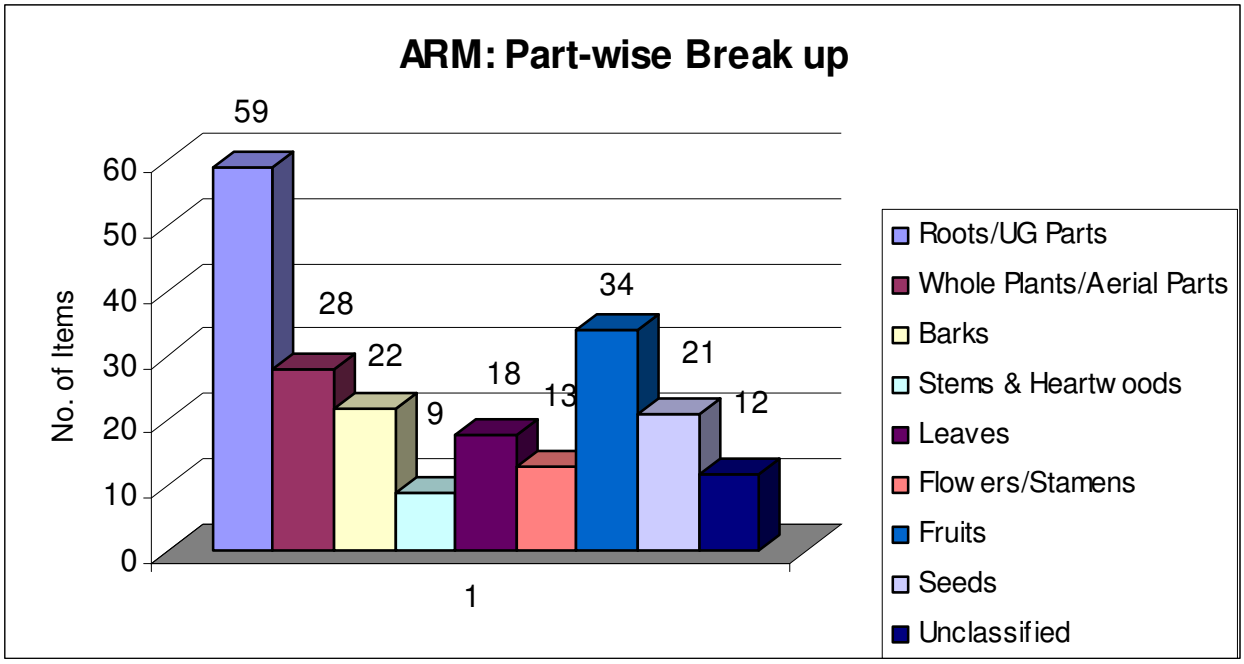
- There are conflicting statements about the direction of supply chains. End users and wholesale markets claim that, it is bottom driven. The traders claim that, the volumes of supplies, their quality and prices are not market driven but decided at grassroots level.
- The tribal collectors engaged at grassroots level claim that, it is top-driven. They indicate that, they receive the demand volumes and indicative price through their middlemen. The collection activity is triggered only on the basis of some clear message reinforcing a market opportunity.
- These conflicting statements in trading mechanism and direction make it difficult to design any kind of technological or market related interventions for ensuring a sustainable resource management.

As a result of these features, the country reached a stage wherein; there are claimants on the wild resources of medicinal plants. But, there are no resource managers anywhere.

Usage Practices

While unorganized mechanisms ruling the collection and trading of medicinal plants, the technical requirement of usage practices also need to a consideration. By and large, botanical drugs require destructive collection. As a matter of natural phenomenon, the biologically active metabolites tend to be deposited in roots, rhizomes, tree barks and heartwoods. Hence, to derive best of medicinal properties from a plant, destructive collection becomes necessary. An analysis of 216 species described in Bhavaprakasha Nighantu (6) and picked-up at random is shown in Figure-II.

Figure-III: Usage Trends in Ayurvedic Medicinal Plants with Reference to Plant Parts (216 Species):



As seen from the above representation, 118 Species (54.63%) the collection requires the frank destruction of the plant. Though flowers, fruits and seeds seem to be renewable plant parts, their collection on commercial basis tend to intervene their natural regeneration cycles. 68 of analyzed species (31.48%) of wild collections tend to prevent natural regeneration.

To sum-up, three major issues together pose high degree of sustainability risks for medicinal plants:

- ***Continued demands for wild botanicals***
- ***Un-organized supply chains and resultant lack of resource management***
- ***Usage practices seeking destructive collection***

This triad of problems is compounded by three more issues:

- ***Natural Factors in Sustainability:*** The nature is designed to evolve through a process of inter-species competition. The species which are not competent and have intrinsic

limitations tend to deplete from their habitats. Interestingly, these weaker species tend to acquire medicinal properties in their struggle for existence. Seed dormancy, endemicity and lack of intra-species genetic diversity make them vulnerable. It is generally stated that at least, one species goes extinct from the surface of our earth every year- due to intrinsic physiological limitations.

- ***Anthropogenic Factors:*** While species extinction is an evolutionary phenomenon, the recent rate of species extinction is increasing multifold. Anthropogenic factos are attributed to persistent loss of biological diversity in recent decades. Loss of habitats due to infrastructure and mining activities encroach into the wild habitats of medicinal plants diversity. Even if compensatory forestation schemes are implemented effectively, the loss to the biological diversity in the natural eco-systems can't be compensated adequately.
- ***Impact on Community Knowledge Systems:*** Forest based tribes have been handling the collection and trading of medicinal plants using inherited knowledge and practices. Thus, a wild medicinal plant is centered on a bio-cultural heritage. When communities are displaced from their habitats due to encroachment, this knowledge system will be lost forever. This eventuality might call for development of knowledge alternatives for harvesting and post harvesting practices.

Thus, the journey towards sustainable utilization of wild medicinal plants in the event of globalization will not be smooth. Despite the best of technological and socio-economic interventions, the process shall be infested with many riddles. More in particular, when the process is to be established for multiple species being used in one single product- there remains scope for uncertainties in the outcomes.

Two significant developments on regulatory front need mention in the context of globalizing Ayurvedic Products:

- Entries of Indian medicinal plants and extracts in US Pharmacopoeia
- Traditional Herbal Medicines Directive (THMPD) released by European Union

Both these developments will herald a new era in the field of Ayurvedic medicinal products and services. The practical impact of these developments may become visible in next one decade. However, the battle remains half-won.

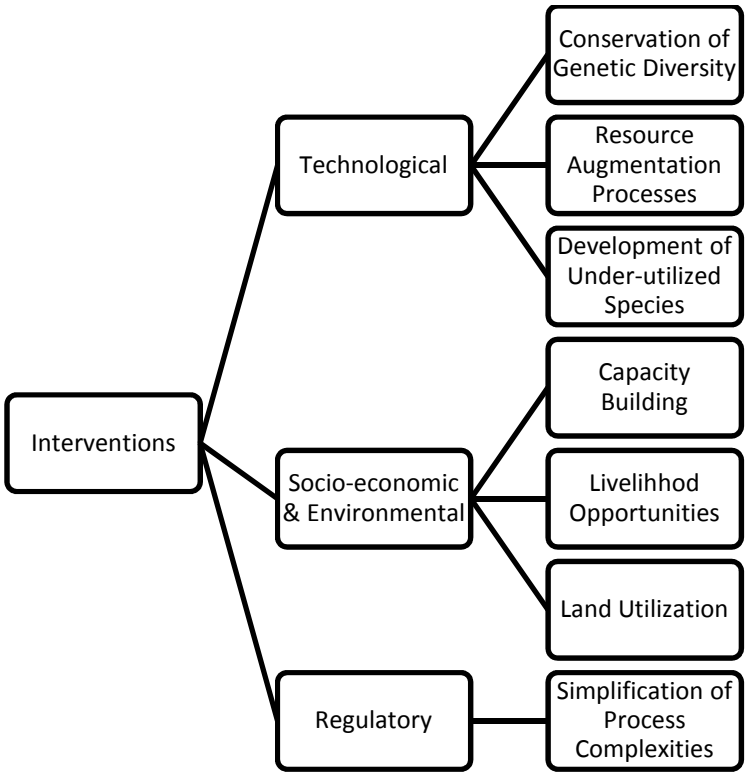
Resource Management for Medicinal Plants- Interventions Needed

Globalization of Ayurveda, Ayurvedic products and services is an emerging economic opportunity. In order to capture this emerging opportunity, there is need for well designed interventions in resource management of medicinal plants. These interventions need to consider few critical factors:

- The resource management plan (RMP) needs to span across 940 species. This number of species is critical to sustain the practice of poly-pharmacy.

- Considering this number- dependence on wild sources is imminent. This reality calls for sophisticated systems for continuous resource mapping.
- The species facing high-degree conservation threats need to be kept in top-priority. Similarly, present volumes of usage need a consideration while prioritizing.
- In many cases, the plan needs to consider the 'intra-species genetic diversity' and conserve the gene pools for futuristic interventions.
- Medicinal plants have specific role in livelihood opportunities for marginal populations- largely comprising of tribal communities.

An over view of desirable interventions are captured in the following illustration



As seen from the above representation- there is no singular path to establish a code for resource management practices. A series of multi-facetted interventions are critical for effective and sustainable management of biological resources. Some of these interventions are explained below:

1) Technological Interventions:

These interventions may be further classified into 3 sub-groups.

a) ***Conservation of Genetic Diversity:*** Intra-species genetic diversity plays significant role in deciding the sustainability of any biological resource. Mapping the genetic diversity

of the species, capturing the populations for each of the geno-type and protecting these characteristic populations are important milestones in conservation programmes. However, such activity at present is largely confined to academic interests only but not on a mission mode. With advancements in the technology for DNA fingerprinting, this process has been already rendered cost effective.

- Taking advantage of this development, a nation-wide programme to capture different genotypes of medicinal plants needs to be designed and implemented. In addition to the 'in-situ' conservation, this intervention needs to include cryo-preservation of different genotypes of species facing high-degree conservation threats.

b) ***Resource Augmentation:*** To cater to the growing needs of commercially important medicinal plants resource augmentation plans need to be developed through a multi-stakeholder approach. This programme is implemented in two models. Where possible, the species is domesticated in a systematic manner and is introduced into farming.

- However, all the herbaceous species of wild origin may not be amenable to domestications due to intrinsic issues. In such cases, production under in-situ conditions through assisted natural regeneration schemes may be opted for.

c) ***Development of Under-utilized Species:*** In case of endangered species, it would be unwise to attempt risky interventions. Ayurveda postulated the concept of 'development of substitutes' and adequately demonstrated this procedure.

- Taking cues from this philosophy, scientific studies need to be initiated to widen the scope of medicinal plants utilization. Similarly, scientific investigations can be initiated to replace un-sustainable plants parts like barks and heartwoods with renewable plant parts.

2) Socio-economic and Environmental Interventions:

These interventions can also be further divided into 3 sub-groups.

a) ***Capacity Building:*** It is undisputable fact that, the communities use inherited skills in handling the collection and post-harvesting processes for wild medicinal plants. However, the quality requirements for medicinal plants remain dynamic- in the event of globalization. Therefore, the question remains whether the end user can rely upon the traditional skills of dependent communities?

- An effective resource management plan needs to encompass the qualitative development of resources as well. For this purpose, a continuous capacity building programme for dependent communities is fundamental.

b) ***Livelihood Opportunities:*** In the present mechanisms of trading, the economic opportunities for communities are well established to be meager. This problem can be addressed only through ethical interventions. It would be unjustified to expect the

communities to practice 'sustainable harvesting systems'- while continuing to struggle for existence.

- A visible improvement in economic opportunities would incentivize the communities to opt for improved harvesting practices and systematic resource management in respective habitats. In this direction, it would be desirable to organize the communities at grassroots level into producer's companies.

c) ***Land Utilization:*** In developing nations like India, land is becoming a precious resource for agricultural purposes. Under these circumstances, diverting agricultural lands for exclusive cultivation of medicinal plants may compromise the family food security of marginal farmers. Therefore resource augmentation through cultivation seems to be difficult proposition.

- To overcome the issue, multiple schemes of land utilization (such as inter-cropping, mixed cropping, agro-forestry models, use of wastelands etc.) need to be evolved.

3) Regulatory Interventions:

- At present, the subject of forestry and biodiversity are governed by multiple laws. The Indian Forest Act-1927 including its state amendments and a host of Forest Acts made by respective State Governments under its scope, Wildlife (Conservation) Act-1972 and Biological Diversity Act-2002 are main statutory instruments. In addition, two more acts (viz. FRA-2006 and PESA) made provisions for accessions to forest resources by dependent communities.

- On the other hand, the policy of participatory management of forests has created welcoming avenues to bring a positive change in medicinal plants resource management. Formation of National Medicinal Plants Board and its state level units SMPBs is also a facilitating mechanism created in the country for conservation and sustainable development of medicinal plants.

- Nonetheless, the whole process is highly complex, missed cohesiveness and sometimes created conflicting environment. There is a need to harmonize regulatory instruments and the facilitator mechanisms. The regulatory intervention needs to encompass, fair and transparent economic gains for the communities, resilient eco-systems supporting medicinal plants diversity and healthier supply chains.

Conclusions

- Globalization of Ayurvedic medicinal products is an imminent event in the evolution of Ayurveda. The process is coined to take the system into a new orbit.
- However, this phase of development is bound to pressurize the resources of medicinal plants- which are not un-limited. These pressures would span across both qualitative and quantitative facets of the resources
- The emerging pressures of globalization on medicinal plants should be visualized from the perspective of poly-pharmacy practices followed by Ayurveda.
- A multi-dimensional intervention is needed to evolve and implement resource management practices to address the emerging pressures on the resource.

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